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12-14 June 2007, at US Naval Academy, Annapolis, MD

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Rapid Equipping Force (REF) Analytical Support



MAJ Eric Tollefson, LTC Jeffrey Schamburg (TRAC-MTRY)

Mr. John Geddes (REF)

MORSS WG28 Presentation

14 June 2007

Agenda

Purpose of this briefing

To describe TRAC-MTRY analytical support to the Rapid Equipping Force (REF).

- **Overview.**
- **Overall methodology development.**
- **Comparison of alternatives decision support tool development.**
- **Analysis guidebook development.**
- **Methodology applications.**
- **Other supporting efforts.**
 - **Human systems integration (HSI) analysis.**
 - **Information technology management analysis.**
 - **Rapid ordering system (ROS) integration.**
- **Conclusions.**

TRAC-MTRY: The US Army Training and Doctrine Command (TRADOC) Analysis Center (TRAC) in Monterey, CA

Research Overview

- **Problem statement: the REF needs an iterative, quick turn-around, standardized systems analysis methodology that considers:**
 - Needs and capability gaps.
 - Comparison and evaluation of alternative solutions.
 - Tactics, techniques, and procedures (TTPs).
 - Lifecycle costs and logistical considerations.
 - Distribution of capabilities.
- **Research objectives.**
 - Develop an iterative, quick turn-around, standardized systems analysis methodology with supporting tools and analyses.
 - Demonstrate their application on a REF system under consideration.
 - Refine and deliver the methodology and supporting tools.

Team Overview

- **Project being conducted as a collaborative effort within a multi-disciplinary team.**
- **Team participants.**
 - MAJ Eric Tollefson, lead analyst and project lead.
 - Mr. Steve Pranger, supporting analyst.
 - LTC Jeff Schamburg, senior analyst.
 - LTC John Willis, former TRAC-MTRY analyst.
 - Mr. Eric Johnson, TRAC Methods and Research Office (MRO).
 - Dr. Gene Paulo, Systems Engineering (SE) team lead.
 - Dr. Tom Housel, Information Science team lead.
 - Dr. Ron Tudor, Business and Acquisition team lead.
 - COL (Ret) Larry Shattuck, Human Systems Integration (HSI) and Operations Research (OR) team lead.
 - NPS students.
 - 7 thesis students (business, OR/HSI, information sciences).
 - 9 class project students (SE, information sciences).
 - Mr. John Geddes, GS-15, REF Technology Management Director.
 - MAJ Robert Lenz, REF analyst.

General Analysis Methodology

Key Characteristics

Familiar	Drawn from other Army, DoD, and business problem solving methodologies and best-practices.
Rapid	Able to be executed quickly, but thoroughly.
Intuitive	Understandable process that requires minimal training, leverages current REF expertise and processes, and uses easy-to-learn supporting tools.
Modular	Series of analyses and tools that can be added or removed based upon schedule or requirements.
Tailorable	Flexible analyses and tools that can be modified by the analysts to match their skills and experience, or refined based upon lessons learned.
Iterative	Analyses that can be repeated and updated as new information becomes available.
Scalable	Can be executed at differing levels of detail.

General Analysis Methodology

Primary Processes

PROBLEM DEFINITION

- 1.0 In-Theater Need Identification.**
- 2.0 Requirements Analysis / Project Validation.**
- 3.0 Technical Course of Action (COA) Analysis.**
- 4.0 Initial Project Decision Briefing.**

SOLUTION DEVELOPMENT AND ANALYSIS

- 5.0 Solution Set Refinement and Analysis.**
- 6.0 Initial Implementation Plan Development.**
- 7.0 Implementation Plan Approval Decision Briefing.**

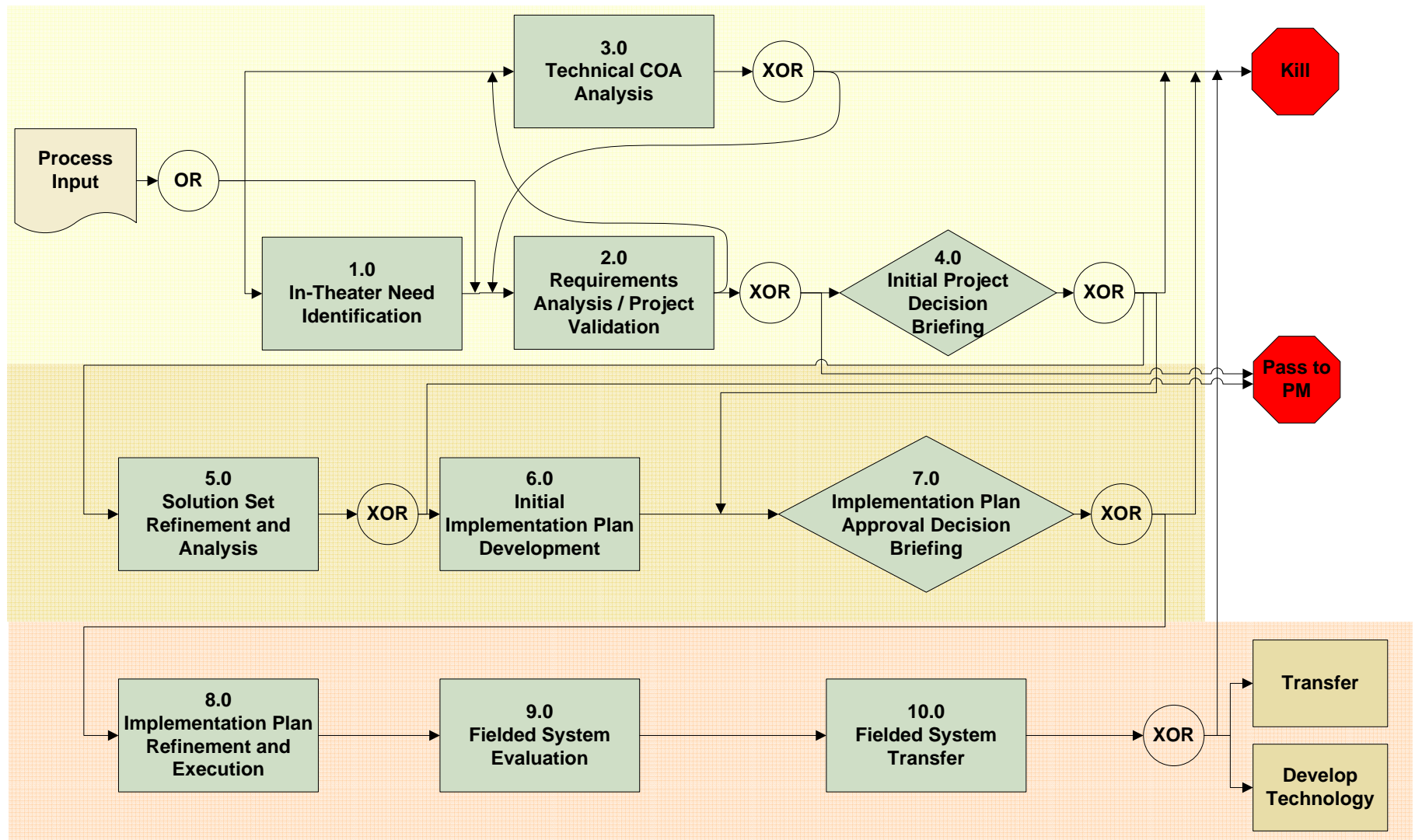
IMPLEMENTATION AND TRANSFER

- 8.0 Implementation Plan Refinement and Execution.**
- 9.0 Fielded System Evaluation.**
- 10.0 Fielded System Transfer.**

***Refined based on applications feedback, REF process assessment work,
and mapping to REF process.***

General Analysis Methodology

Flow Diagram



XOR – Exclusive OR – only one branch may be followed.

Analysis Guidebook

Overview

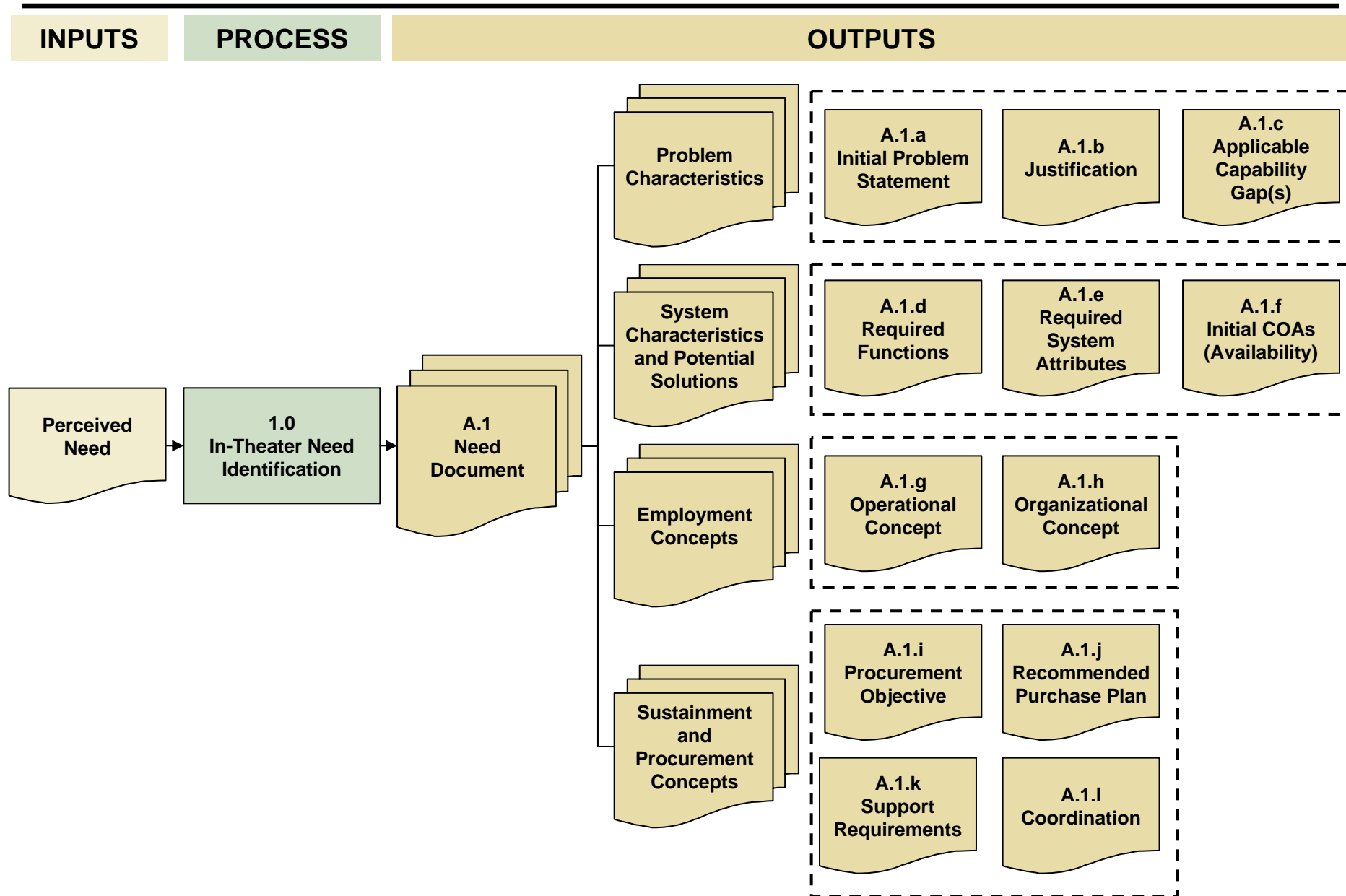
Purpose: *to provide REF analysts a quick reference guide that describes the overall REF analysis process.*

- **Concept.**
 - Develop an easy-to-understand and succinct reference guide for REF analysts.
 - Identify key aspects of each analytical process and sub-process.
 - Suggest potential tools and techniques to support REF analyses.
- **Description.**
 - Maps the inputs and outputs of each process and decomposes each of the processes into sub-processes.
 - Briefly describes the inputs and outputs of the processes.
 - Briefly describes of each of the sub-processes.
 - Identifies potential supporting tools and techniques.
- **Developed in MS PowerPoint in an easily-referenced format.**
- **The next two slides show an example of the input-to-output mapping for the first analytic process and an example of its decomposition into sub-processes.**

The analysis guidebook will provide all REF analysts, regardless of their analytical background, a common framework for REF analyses.

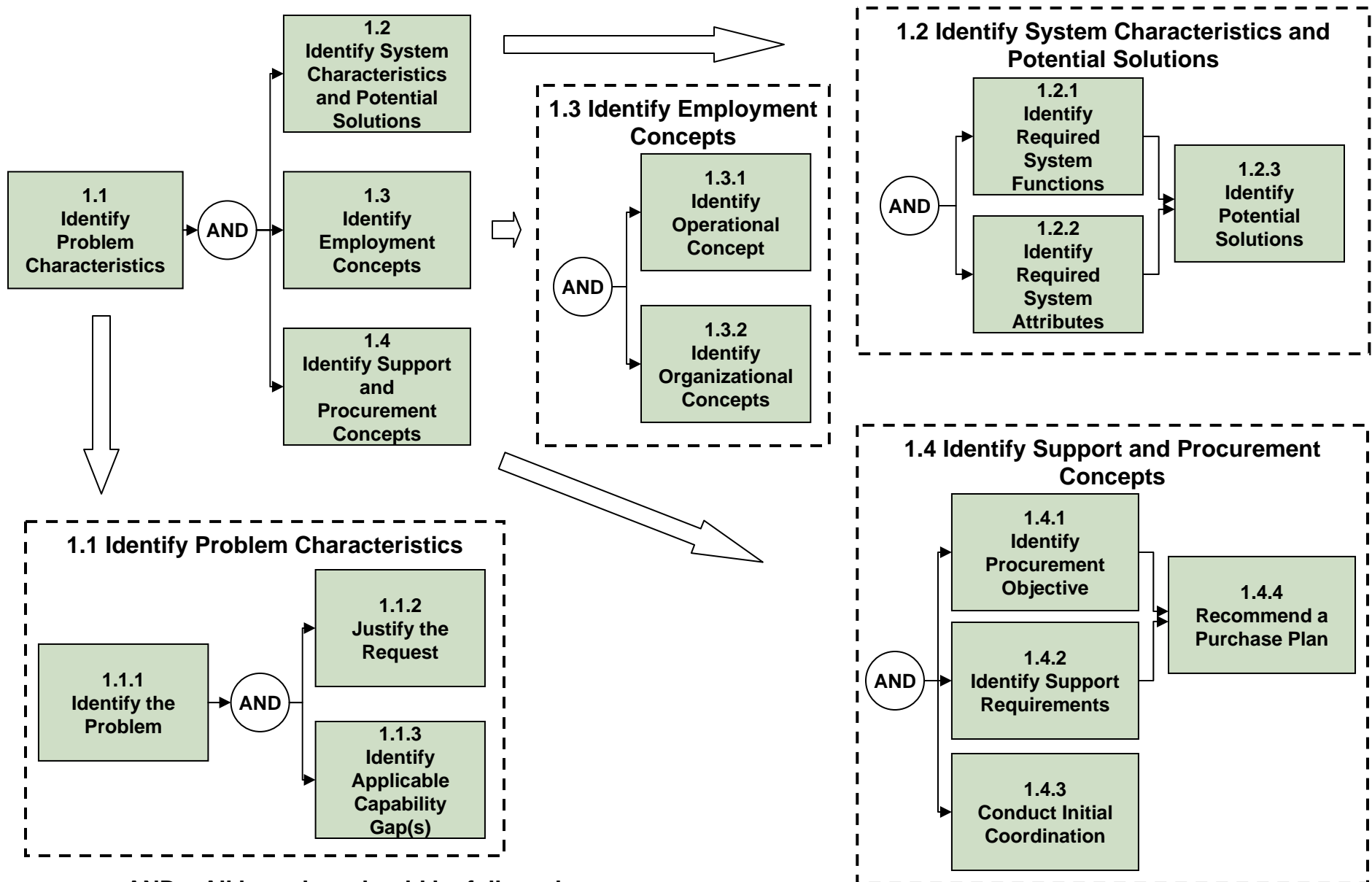
1.0 In-Theater Need Identification

Inputs to Outputs



1.0 In-Theater Need Identification

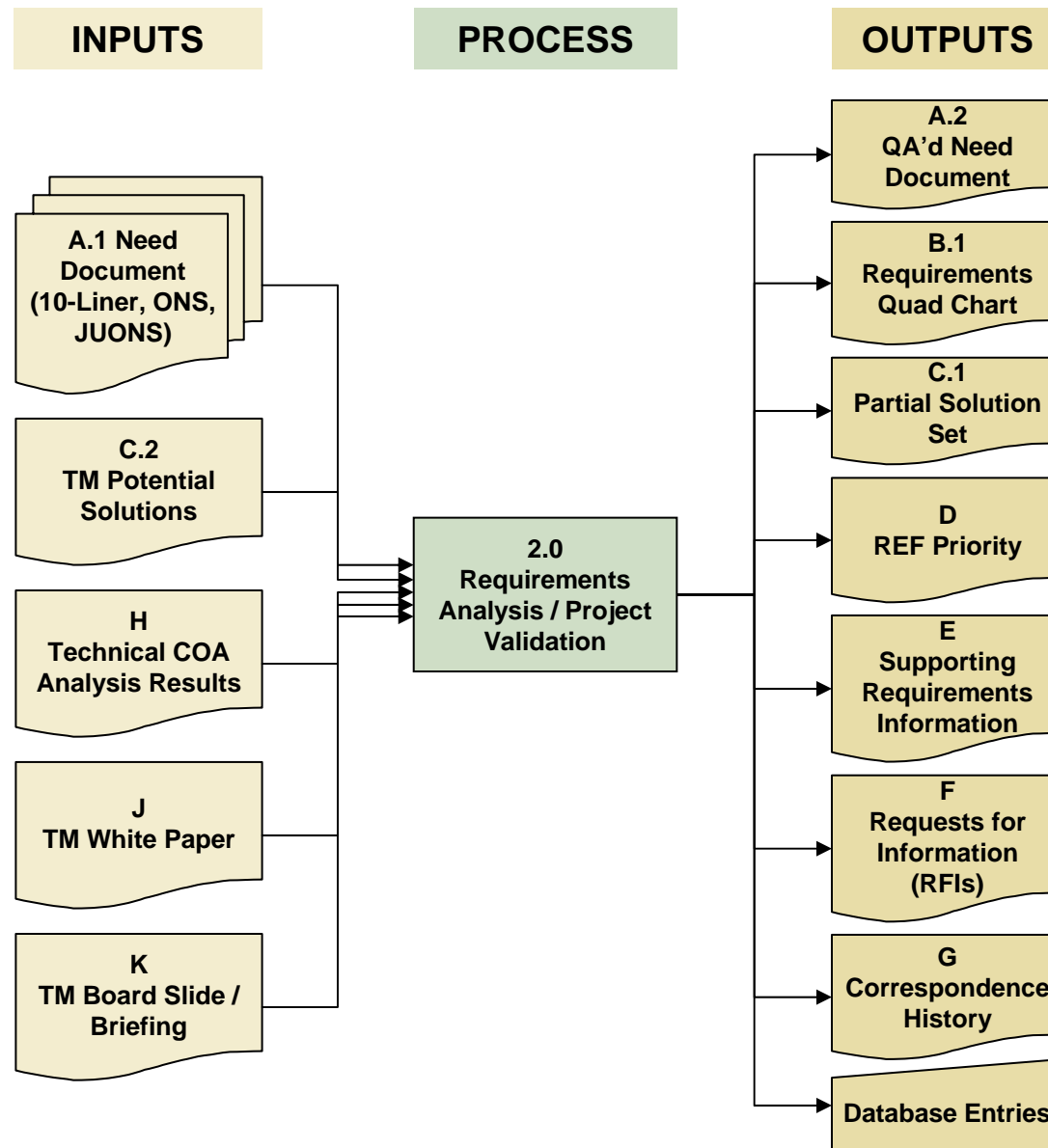
Sub-processes



AND – All branches should be followed

2.0 Requirements Analysis / Project Validation

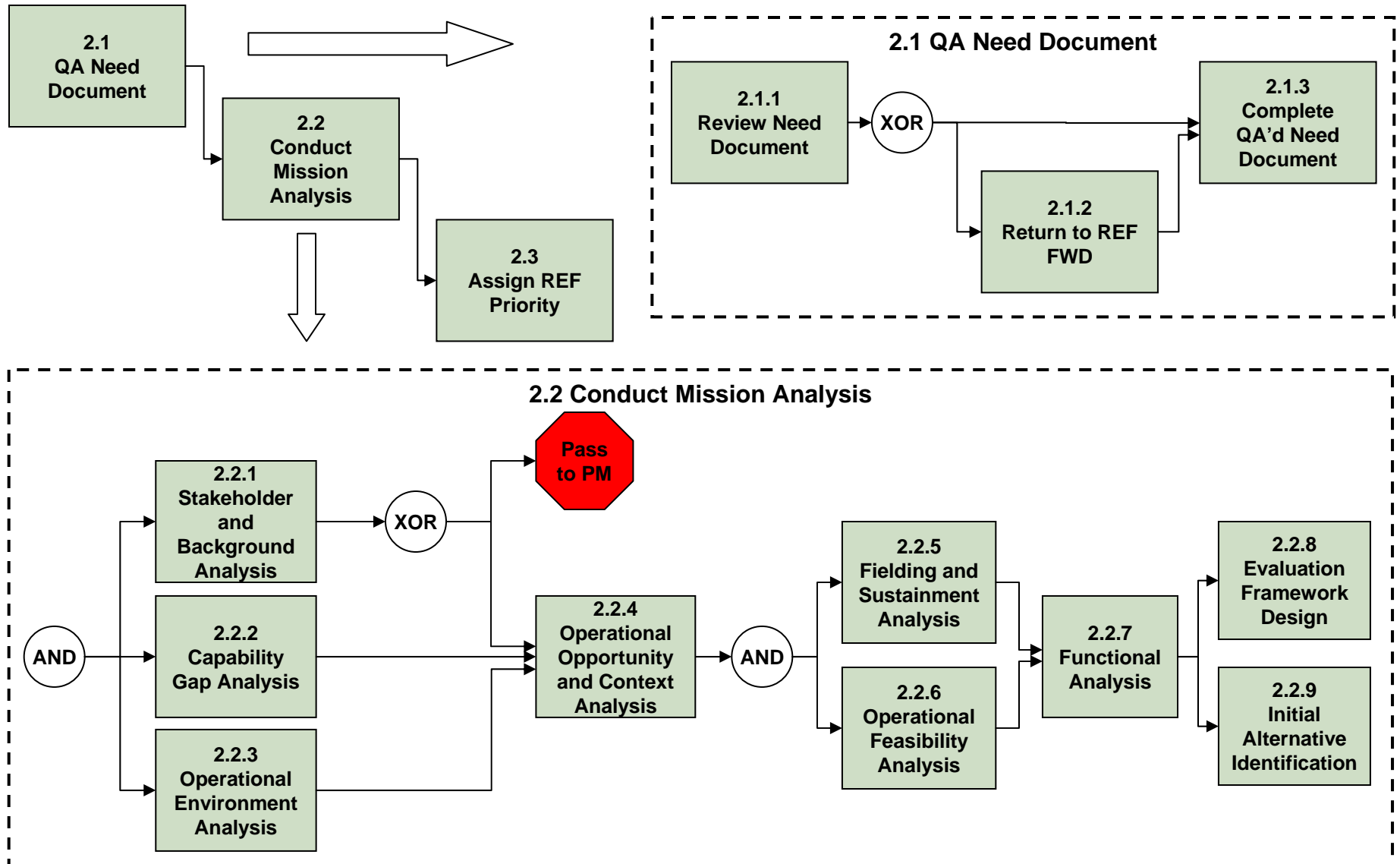
Inputs to Outputs



TM – Technology Management

QA – Quality Assurance

2.0 Requirements Analysis / Project Validation Sub-processes



REF FWD – REF Forward Element in Theater

2.0 Requirements Analysis / Project Validation

Discussion (Slide 1 of 4)

- **Purpose:** To transform an initial need identification into a thorough set of requirements by refining the initial need documentation and conducting a detailed mission (need) analysis.
- **Rationale:** As with the initial identification of the need, this essential step in defining the problem and determining the requirements is critical to the success of the project. The requirements identified in this process is the foundation upon which the ultimate recommendation of a solution and the implementation plan will be based.
- **Inputs:** The primary input to this process is a 10-Liner, Operational Need Statement (ONS), or a Joint Use Operational Need Statement (JUONS). Inputs could also include documentation from the REF Technology Management team as they vet 'good ideas', new technologies, insert technologies, or command-directed technologies.
- **Sub-process Discussion:**
 - **2.1 QA Need Document:** In this step, the team receives a need identification from the field (10-Liner, ONS, JUONS) and reviews it for completeness. If the documentation is missing critical information, the team returns it to the originator for clarification. Some information is not required to be complete in the Need Document (e.g., organizational concept, procurement objective, support requirements, and availability). The output is a QA'd need document.
 - **2.2 Conduct Mission Analysis:** This is a very complex step and includes numerous sub-steps to ensure that the initial need statement is accurately transformed into a thorough set of requirements. A discussion of these sub-steps is essential to understand this process.
 - **2.2.1 Stakeholder and Background Analysis:** The team begins this step immediately and continues to execute it throughout the entire process. A stakeholder can be defined as anyone with a vested interest in, or influence upon, the problem. The team will identify and interview stakeholders for almost every aspect of Mission Analysis. Because time is a limited commodity for all stakeholders, the team must put thought into the information they need before they begin their interviews. Key stakeholders will include the unit, threat subject matter experts (SMEs), other operational SMEs, REF personnel, project managers (PMs), maintenance and sustainment SMEs, industry, and other personnel who can help provide or clarify required information. Additionally, the team will check with DAMO-CIC to determine if they are working on a similar ONS prior to an AR2B. In conjunction with interviewing stakeholders, the team will also conduct background research to clarify their information. The key outputs of this step are a correspondence history and the information provided by the stakeholders and through the background research. In some cases, if a PM solution has been identified to meet the need, this process can end with transition to the PM.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 2 of 4)

- **Sub-process Discussion (continued):**

- **2.2 Conduct Mission Analysis (continued):**

- **2.2.2 Capability Gap Analysis:** The team will refine the capability gaps identified by the REF FWD team (if provided) and identify applicable sub-capability gaps as well. The team should try to identify the frequency with which the gap occurs and the impact of the gap on the unit.
 - **2.2.3 Operational Environment Analysis:** The team will describe the operational environment in which the solution will be used, identify ROE and other legal considerations, and understand the threat and how the threat might defeat and/or adapt to the employment of the solution.
 - **2.2.4 Operational Opportunity and Context Analysis:** This analysis captures how the potential solution may be employed, in terms of tactics, techniques and procedures (TTPs), identifies potential drawbacks/penalties of the system, identifies other systems with which the potential solution will have to interoperate, identifies how often the potential system will be available to the unit for use, and how often situations will occur for which the system will provide benefit. The latter two analyses help the REF determine if the fielded solution will actually provide significant benefit to the unit, versus only occasional benefit. These results should be balanced with the frequency and impacts of the gap itself to help the REF prioritize the current requirement with other competing requirements.
 - **2.2.5 Fielding and Sustainment Analysis:** This analysis captures the number of systems that are required and whom they will be fielded to (basis of issue – number by echelon), the expect logistical footprint required to support the system (manpower, spares, facilities, special equipment) and an initial estimate of the lifecycle cost (procurement, maintenance, sustainment, etc.) of a potential solution (to help identify the funding source) and an estimate of the fielding schedule.
 - **2.2.6 Operational Feasibility Analysis:** This analysis captures the organization, training, leader education, and personnel impacts of fielding the system and includes the human factors issues (comfort, usability, etc.) associated with the fielded systems' impacts on the users, leaders, and maintainers.
 - **2.2.7 Functional Analysis:** This analysis defines in greater detail the required functions of the system in terms of what the system must do in order to mitigate the capability gap and satisfy the unit's need. This is primary step for defining the requirements of the potential materiel solution and provides the basis for alternative identification and the evaluation framework that will be used to compare the alternatives. It is important, when defining the functions, to define them independently of potential solutions already being considered.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 3 of 4)

- **Sub-process Discussion (continued):**

- **2.2 Conduct Mission Analysis (continued):**

- **2.2.8 Evaluation Framework Design:** This step should flow directly from the functional analysis and the stakeholder analysis. The objectives of the stakeholders should be combined with the required functions to define the desired performance by function. The team will then derive criteria from those objectives that will be used to measure and evaluate alternative performance. Criteria come from the system attributes defined in the 10-Liner, measures suggested by stakeholders, and other measures developed by the team. Criteria must be developed in such a way that is not specific to a particular solution so that they can be used to evaluate any potential alternative. Criteria can either be natural (a clearly defined and understood scale, like pounds) or constructed (created specifically to measure the performance of a particular function/objective, such as a 5-star rating for safety). Once a list of criteria has been established, the team must weight the criteria according to the importance of the primary stakeholders, so that comparisons can be made. The evaluation framework will be refined and completed later by the Project Officer.

- **2.2.9 Initial Alternative Identification:** In this step, the team will compile a set of potential solutions, which will come from the unit, other stakeholders, and other sources. The team should consider non-materiel alternatives within the DOT_LPF* domains as well.

- **2.3 Assign REF Priority:** The requirements team should assign a priority (routine, essential, or urgent) to the requirement based primarily upon unit/REF FWD recommendation, but also upon the Mission Analysis conducted as part of this process.

*DOT_LPF: Doctrine, Organization, Training, Leader Education, Personnel, Facilities (Materiel omitted)

- **Potential Tools and Techniques:**

- **Stakeholder Analysis:** The key to the success of this process is the interaction between the REF analysis teams and key stakeholders.

- **TRADOC ARCIC Current Force Capability Gap Documentation:** Provides a description of the currently-approved capability gaps, sub-capability gaps, and potential solutions for mitigating the gaps.

- **Human Systems Integration (HSI) Tool:** Tool developed by TRAC-MTRY to assist in the identification of potential HSI and DOTMLPF issues associated with fielding a materiel solution.

- **System Decomposition:** A technique to decompose the required solution into its component parts, structure, and functions. This is a good technique for gaining an understanding of the system and its key elements.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 4 of 4)

- **Potential Tools and Techniques (continued):**

- **System Context Diagram:** A technique used to place the system and its sub-systems in the context of the operational environment, which is helpful for identifying interoperability issues, potential TTPs, and echelon of system employment.
- **Legal Advice:** Army lawyers can help identify unique legal requirements for certain types of systems under consideration.
- **Functional Decomposition:** Techniques, such as functional hierarchies and functional flow diagrams, used to decompose the need into required functions.
- **Objectives:** A method of thinking that translates required functions into desires concerning performance that can help lead directly into the criteria or measures for alternative evaluation.
- **Value Measures:** Techniques for developing criteria to capture the value of the key aspects of alternative performance for evaluation and comparison purposes.
- **Value Hierarchy:** Technique used to capture the evaluation framework that starts with the functions and flows into objectives and then criteria, or value measures.

- **Outputs:**

- **QA'd Need Document.**
- **Requirements Quad Chart:** Pre-defined REF document that includes a succinct description of the problem (this should be a more complete, revised problem statement that builds upon the initial problem statement included in the Need Document), a photo of the potential solution (if identified), a description of the system (either explicitly, if a solution has been identified, or in terms of requirements if a solution has not been identified), the applicable TRADOC ARCIC Current Force capability gap(s) and sub-capability gap(s), proposed and recommended courses of action for the procurement of the solution, the requesting activity, identification of similar items REF may have considered in the past, an initial sustainment strategy, and a potential vendor (if identified).
- **Partial Solution Set:** A set of potential materiel solutions described in an Excel spreadsheet.
- **REF Priority.**
- **All of the supporting Requirements Analysis / Project Validation products.**
- **Unanswered Request for Information (RFIs).**
- **Stakeholder Correspondence History:** A log of the critical discussions between the requirements team and key stakeholders.
- **Required Database Entries.**

Comparison of Alternatives Decision Support Tool

Overview

Purpose: *to develop a comparison of alternatives decision support tool for rapidly and quantitatively researching, analyzing, and selecting the best materiel solution.*

- **Concept.**

- Provide the user a rapid means to:
 - Enter criteria and alternative data.
 - Weight the criteria.
 - Score the alternatives.
- Present the user with analysis products to facilitate:
 - Alternative comparison.
 - Cost-benefit analyses.
 - Sensitivity analyses.

- **Prototype Decision Support Tool.**

- Uses Microsoft Excel as the primary platform.
- Provides user-friendly interface and performs actions via Excel formulae, ActiveX controls, and VBA code.
- Plan to provide both simple and complex weighting and scoring methods.

A decision support tool will facilitate rapid, quantitative alternative comparisons while considering critical evaluation measures.

General Analysis Methodology

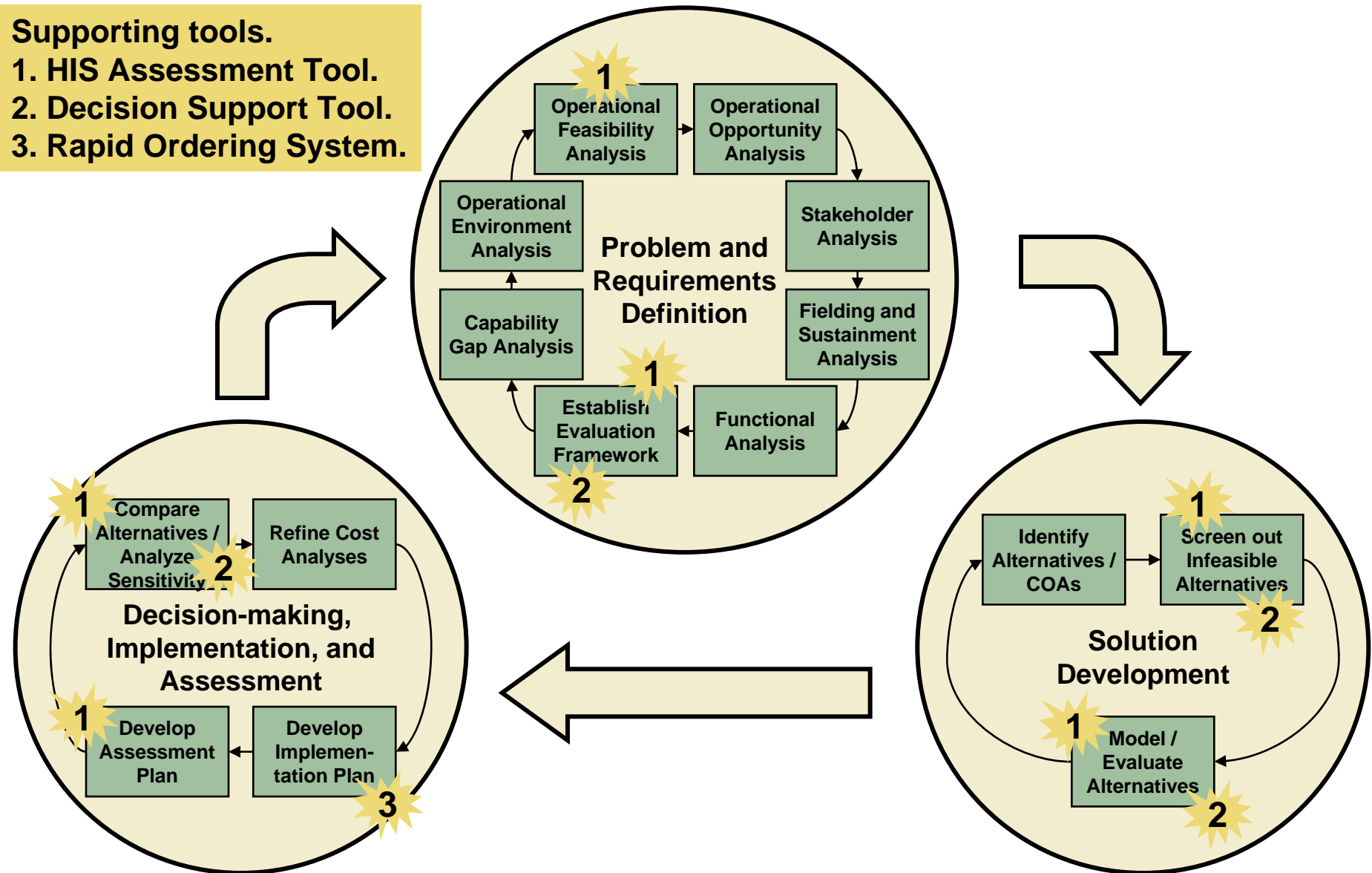
Applications

- **Initial case study, conducted in Fall, 2006.**
 - **Notional system under consideration: improved body armor.**
 - **Lessons learned.**
 - **Quantitative analysis can be valuable in making a quality decision.**
 - **Tools and techniques provided to the REF analysts must be easy-to-learn and intuitive, not requiring extensive analytical background.**
 - **Varied nature of the problems and materiel solutions that REF analysts will consider require flexibility in the design approach.**
 - **Stakeholder input is essential, yet often difficult to obtain; useful to start with analysts' opinions and then seek stakeholder revision.**
- **Methodology development support.**
 - **Demonstrated methodology tailorability for a particular project under consideration at the REF.**
 - **Delivered tailored methodology, but did not execute.**
- **Limited case study considering green laser alternatives conducted in Spring, 2007.**
 - **Demonstrated application of the Decision Support Tool (DST).**
 - **Led to DST refinements.**
- **Subsequent case studies to be conducted in June.**
 - **Conduct study on a REF system under consideration.**
 - **Execute the methodology from start to finish.**
 - **Make final refinements based upon lessons learned before delivery to the REF.**

General Analysis Methodology Overview

Supporting tools.

1. HIS Assessment Tool.
2. Decision Support Tool.
3. Rapid Ordering System.



Weapon-mountable Green Laser Application

DST Input Screens

Criteria	Criterion Status	Criterion Importance
Weight	Include	High
Output Power	Include	Low
Beam Divergence	Include	Average
Rail Mountability	Include	Very High
Range	Include	High
Battery	Include	Low
Vendor Reliability	Include	High
Criterion 8	Don't Include	-- Select --
Criterion 9	Don't Include	-- Select --
Criterion 10	Don't Include	-- Select --

Simple Criterion Weighting: The user chooses criterion importance: very low, low, average, high, or very high.

Criteria Selection and Simple Weighting

Simple Alternative Scoring: The user evaluates the performance of each alternative for each included criterion: not at all, poor, adequate, good, or excellent.

User chooses to include or not include criteria and alternatives, giving the user the flexibility to add or remove criteria or alternatives throughout the process.

Alternatives →			Helios Dazzler	PD/G-105 Dazzler	Mini Green	GBD 3	BTG 2S	Comfort Class 3	GL V5	S532A	Alternative 9	
Alternative Status →			Include	Include	Include	Include	Include	Include	Include	Include	Don't Include	
Alternative Evaluations →	Weight	Include	Poor	Excellent	Good	Adequate	Adequate	Good	Adequate	Good	-- Select --	
	Output Power	Include	Excellent	Adequate	Adequate	Good	Poor	Poor	Poor	Poor	-- Select --	
	Beam Divergence	Include	Good	Adequate	Excellent	Excellent	Adequate	Adequate	Adequate	Adequate	-- Select --	
	Rail Mountability	Include	Excellent	Excellent	Excellent	Adequate	Poor	Poor	Poor	Poor	-- Select --	
	Range	Include	Poor	Poor	Adequate	Excellent	Good	Poor	Good	Good	-- Select --	
	Battery	Include	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	-- Select --	
	Vendor Reliability	Include	Excellent	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	-- Select --	
	Criterion 8	Don't Include	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	
	Criterion 9	Don't Include	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	
Criterion 10	Don't Include	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --	-- Select --		
Total Lifecycle Cost			Include	\$	\$5,000	\$1,299	\$5,000	\$8,950	\$55	\$24	\$99	\$99

Alternative Selection and Simple Evaluation

Cost information for cost-benefit analyses.

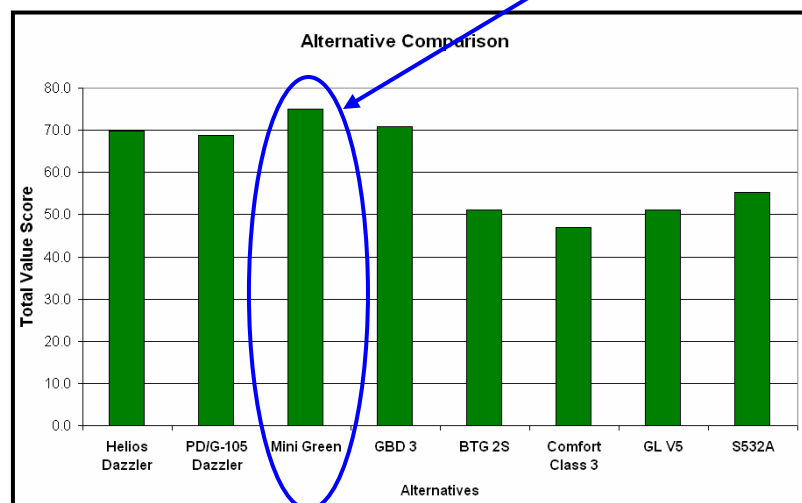
Weapon-mountable Green Laser Application

Alternative Comparison DST Outputs

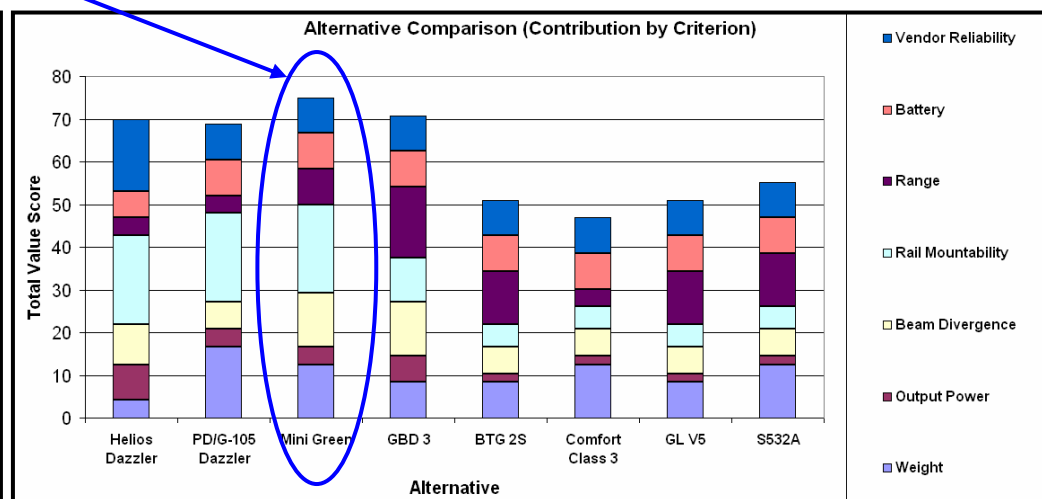
Criteria	Criteria Weights	Alternatives							
		Helios Dazzler	PD/G-105 Dazzler	Mini Green	GBD 3	BTG 2S	Comfort Class 3	GL V5	S532A
Weight	0.167	25	100	75	50	50	75	50	75
Output Power	0.083	100	50	50	75	25	25	25	25
Beam Divergence	0.125	75	50	100	100	50	50	50	50
Rail Mountability	0.208	100	100	100	50	25	25	25	25
Range	0.167	25	25	50	100	75	25	75	75
Battery	0.083	75	100	100	100	100	100	100	100
Vendor Reliability	0.167	100	50	50	50	50	50	50	50
Total Value Score	1.000	69.8	68.8	75.0	70.8	51.0	46.9	51.0	55.2

Decision Matrix

Highest Scoring Alternative



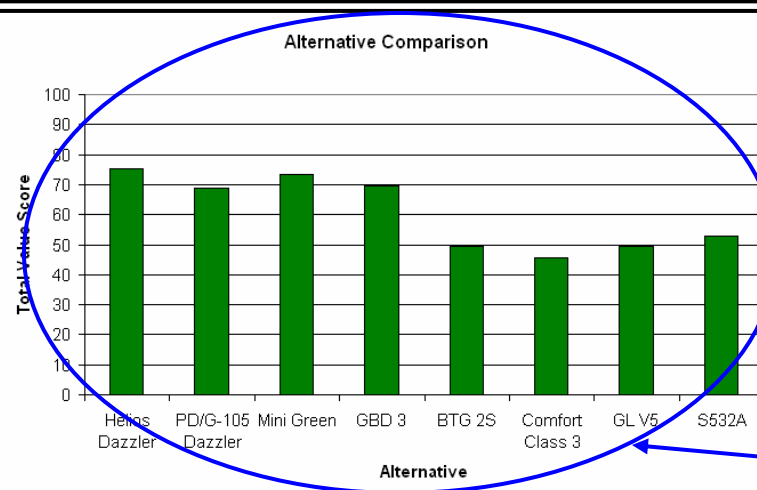
Total Value Score Comparison Chart



Total Value Score Comparison Stacked Column Chart

Weapon-mountable Green Laser Application *Sensitivity Analysis DST Outputs*

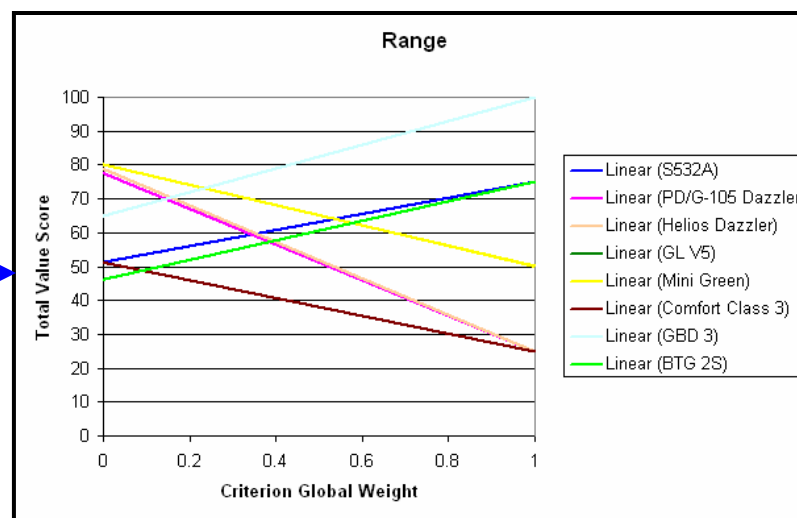
Slider bars allow the user to adjust the weights of multiple criteria to see the effects on the alternative total value scores.

[illegible]

Dynamic comparison chart shows the effects on alternative total value scores from criterion weight changes.

Alternative Comparison Chart with Dynamic Sliders Bars For Sensitivity Analysis of the Criteria Weights

Sensitivity charts for each criterion show the effect on alternative total value scores due to changes in the individual criterion global weight.

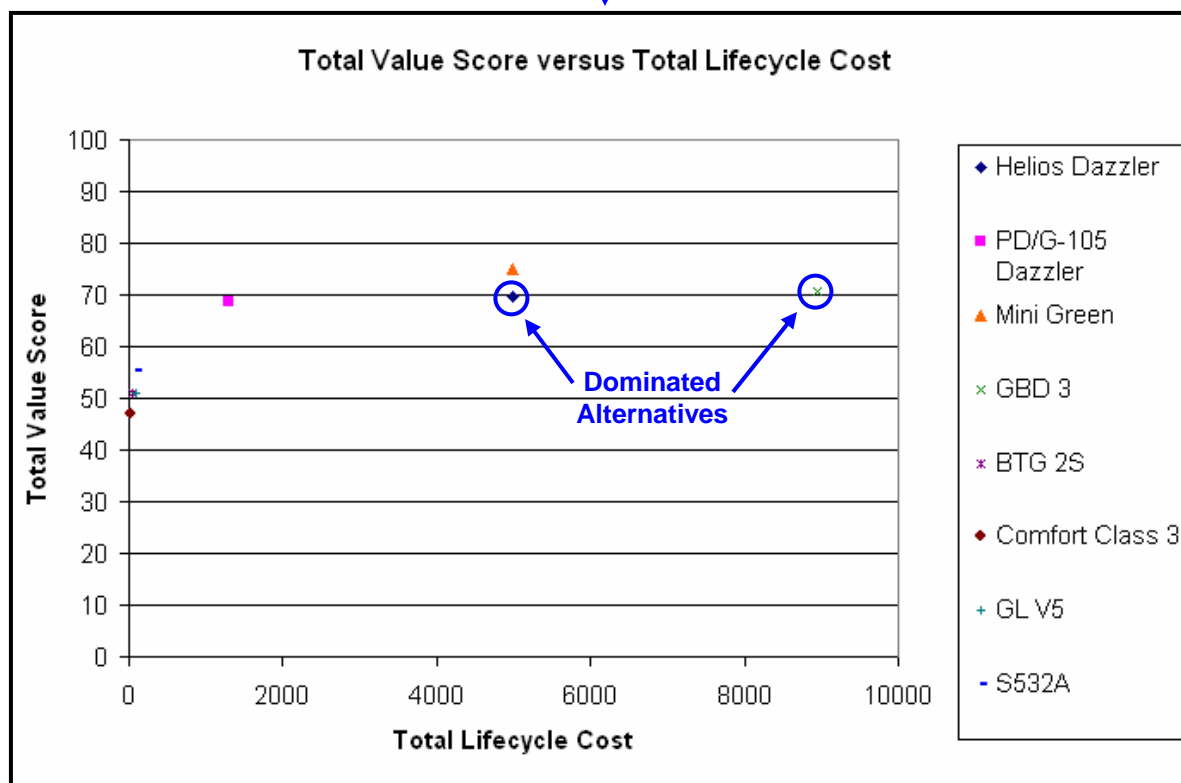


Laser Range Sensitivity Analysis Chart

Weapon-mountable Green Laser Application

Cost-Benefit DST Output

Cost-benefit chart shows each alternative's total value score versus its cost.



Cost-Benefit Chart

Shows the decision maker the added benefit provided by increased cost and readily identifies dominated alternatives (alternatives that provide less value but cost more than another alternative).

Human Systems Integration (HSI) Analysis Overview

Purpose: to integrate manpower, personnel, training, human factors engineering, habitability, survivability, and environment, safety and occupational health considerations into the system acquisition process.

- HSI provides a human performance perspective of system integration.
- HSI analyses explicitly evaluate and integrate the seven functional human-related areas (HSI domains) into the systems acquisition process.
- Developing a tool capable of:
 - Supporting comparisons of alternatives from an HSI perspective.
 - Developing customized questionnaires to provide item-specific feedback and analysis of item effectiveness from an HSI perspective.
- MAGTF C2 Test Branch, US Marine Corps, has already seen and requested a copy of the tool.

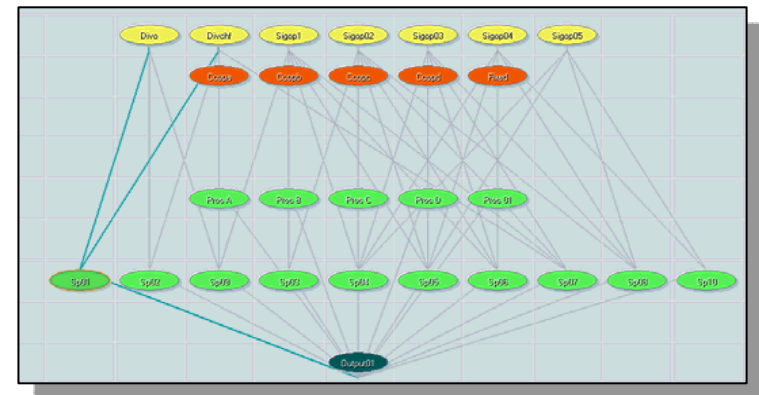
Screenshot from Prototype Tool

Consideration of HSI factors is critical due to short acquisition timelines and the fact that REF systems will be directly integrated into operational units.

Information Technology Management Analysis Overview

Purpose: to develop a framework to assess and redesign core business processes with information systems to support potential process improvement within REF.

- **Knowledge Value Added (KVA) analysis.**
 - Views organization as portfolio of knowledge assets deployed to create value (people and systems).
 - Assesses value of intellectual capital and information technology.
 - Provides a value benchmark for comparisons across all processes.
 - Permits tracking of value over time.
- **Deliverables.**
 - A baseline model to estimate the relative returns on investment (ROIs) for REF processes.
 - Alternative process models, job descriptions, and a table of the improvements in relative returns for each model.



GaussSoft Software Used for Analyses

Analyses will provide valuable input for identifying potential processes for improvement and for examining the value of potential strategic options.

Rapid Ordering System (ROS) Integration Overview

Purpose: *to streamline the contracting system used by the REF through the integration of the Rapid Ordering System (ROS).*

- **ROS vision.**
 - On-line graphical user interface (GUI) for contracting.
 - Accesses every potential vendor interested in supporting DoD.
 - Accesses electronic vendor catalogs directly for data searching.
 - Prepares all contract ordering documents (narratives and forms).
 - Connects IDIQ contracts from all Government contracting offices.
 - Is accepted and incorporated into the entire DoD contracting process.
 - Creates automated re-ordering.
 - Automated closeout.

Implementation of the ROS within the REF has the potential to shorten the acquisition timeline significantly and reduce workload.

Rapid Ordering System (ROS) Integration

Sample ROS Interfaces

Vendor Items

Vendor Item No	Description
5000-0001	IDAS Integrated Dismounted Armor System, Small - Marpat
5000-0002	IDAS Integrated Dismounted Armor System, Medium - Marpat
5000-0003	IDAS Integrated Dismounted Armor System, Large - Marpat
5000-0005	IDAS Integrated Dismounted Armor System, Small - 3 Color Desert
5000-0006	IDAS Integrated Dismounted Armor System, Medium - 3 Color Desert
5000-0007	IDAS Integrated Dismounted Armor System, Large - 3 Color Desert
5000-0009	S-SAPI Secondary Small Arms Protective Insert - Coyote Brown
5000-0013	IDAS(G) Integrated Dismounted Armor System (Gunner), Small - Army Digital Green (ACU)
5000-0014	IDAS(G) Integrated Dismounted Armor System (Gunner), Medium - Army Digital Green (ACU)

Approved Vendor Items

Vendor: Unit of Measure:

My Vendor:

Item Number:

Item Description:

Vendor's Item Number:

Vendor's Description:

Item Size:

Unit Price:

Extended Description:


Manufacturer Name:

Photo URL:

View Photo: <http://www.med-eng.com/fp/ros/photos/S-SAPI.jpg>

Specification Url:

View: http://www.med-eng.com/fp/ros/pdfs/SAPI_Apri



S-SAPI

Available in: Coyote Brown, 3 Color Desert and Army Digital Green (ACU)

1 - RFP Entry

Project	RFP Name	Created	RFP Id
Marine Undergarment Purchase	Quantico Undergarment Purchase 2	5/12/2006	39
Aug3Vend2	Frank Test	10/4/2006	92
Ron's Project	Ron's Test		93

Request Details

Procurement Type:

Project:

Created By:

RFP Name:

Extended Description:

Status:

Created Date:

Request Date: Calendar

Deliver By Date: Calendar

Respond By Date: Calendar

Issuer Contact:

Issuer Contact Email:

Issuer Contact Phone:

Ship To:

Ship To DODAAC:

Ship To Contact:

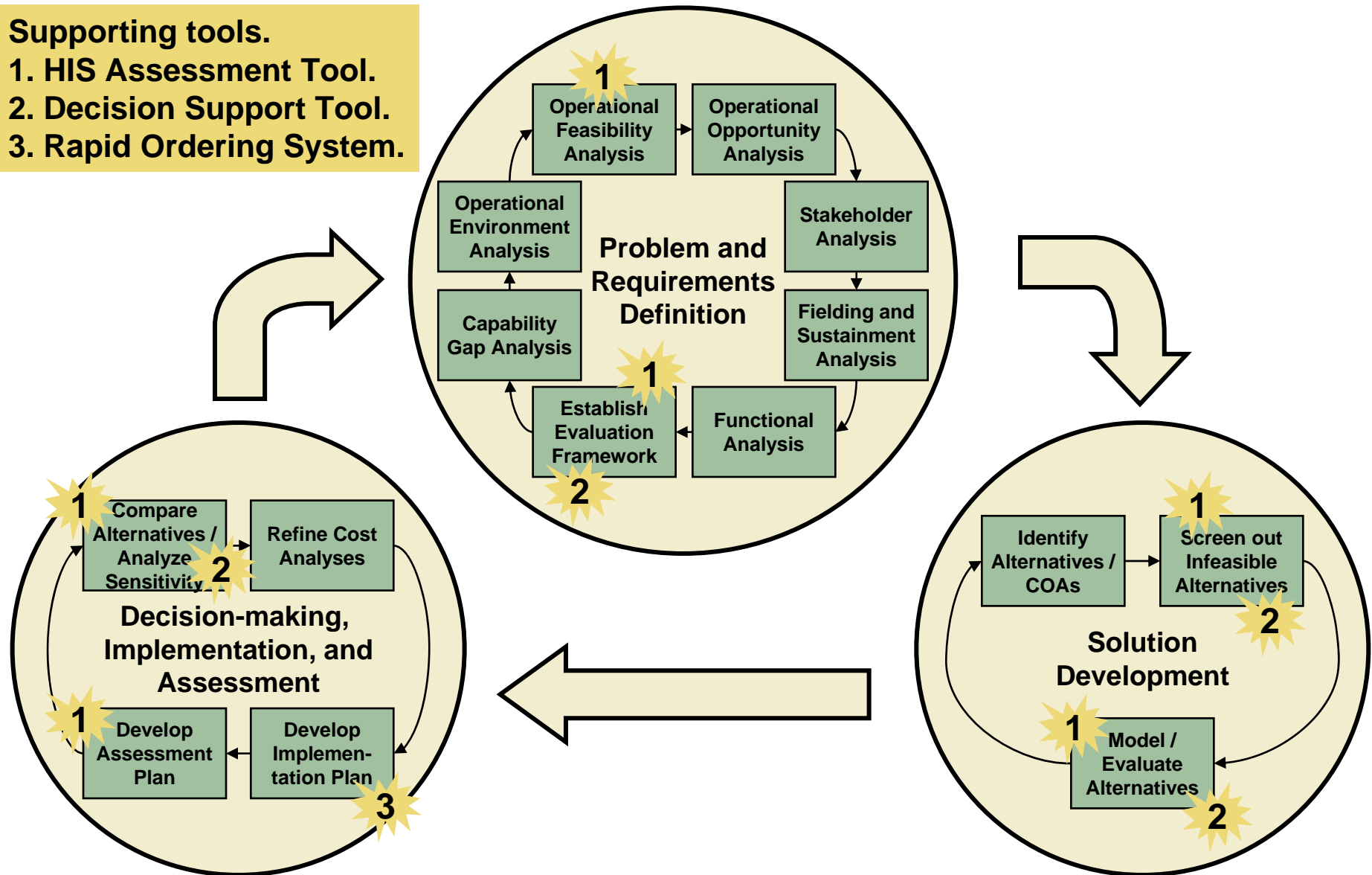
Internal Notes:

Is Price Factor?: ☐

General Analysis Methodology Overview

Supporting tools.

1. HIS Assessment Tool.
2. Decision Support Tool.
3. Rapid Ordering System.



Conclusions

- **This collaborative, multi-disciplinary effort has resulted in a series of techniques and tools that will be valuable to the REF and that may be leveraged for other organizations.**
- **Will benefit the REF by providing:**
 - **An iterative, quick turn-around, standardized systems analysis methodology with supporting tools and analyses.**
 - **An analysis guidebook to provide all REF analysts, regardless of their analytical background, a common framework for REF analyses.**
 - **A decision support tool to facilitate rapid, quantitative alternative comparisons while considering critical evaluation measures.**
 - **A means to consider critical HSI factors during requirements analysis and project evaluation after fielding.**
 - **Valuable input for identifying potential processes for improvement and for examining the value of potential strategic options.**
 - **A rapid contracting system to shorten the acquisition timeline and reduce workload.**
- **Many portions of this work have already been well-received.**
 - **Human systems integration (HSI) tool.**
 - **Tailored methodology.**
 - **Concept of the Rapid Ordering System.**

Rapid Equipping Force (REF) Analytical Support



MAJ Eric Tollefson, LTC Jeffrey Schamburg (TRAC-MTRY)

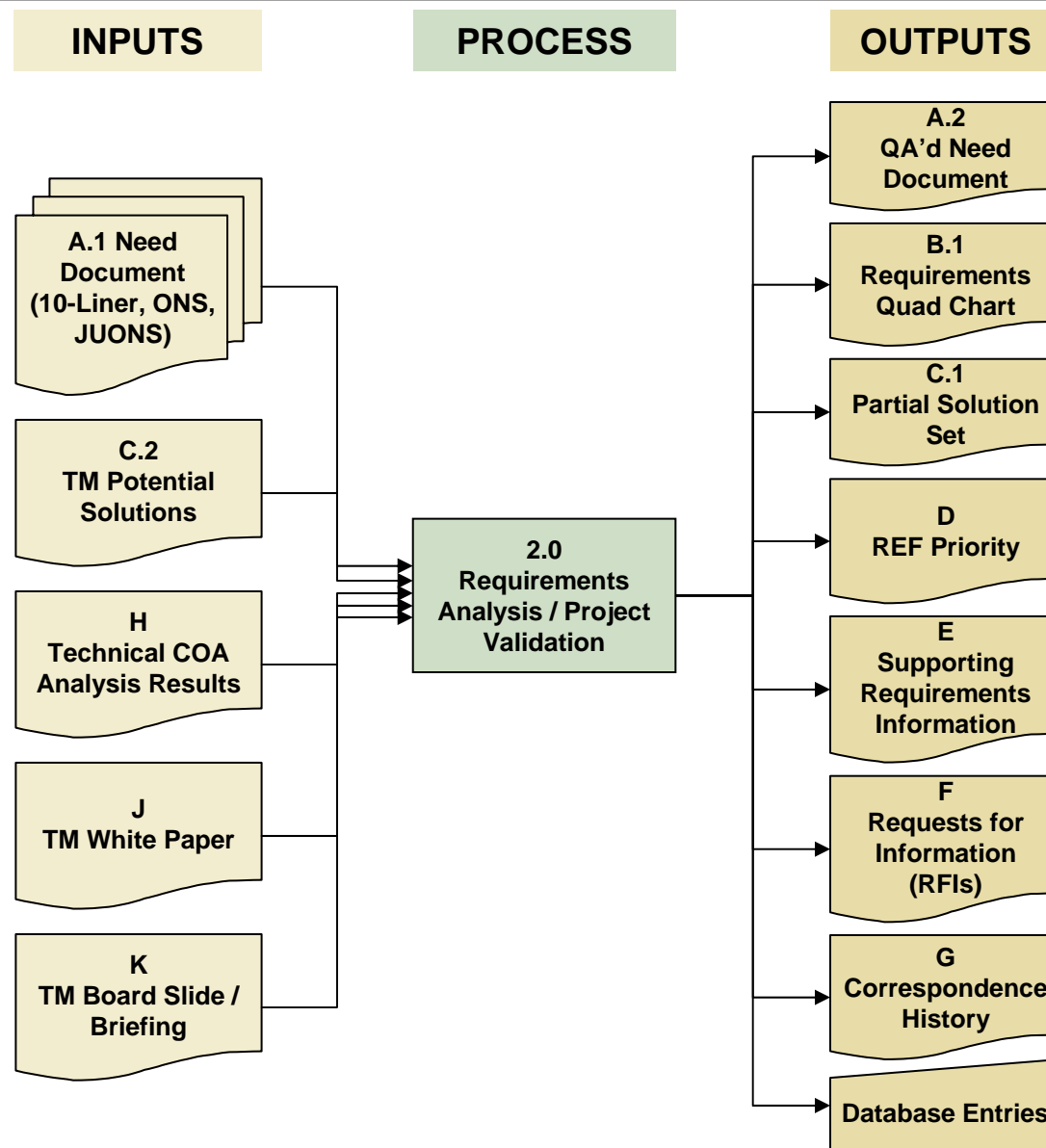
Mr. John Geddes (REF)

MORSS WG28 Presentation

14 June 2007

2.0 Requirements Analysis / Project Validation

Inputs to Outputs

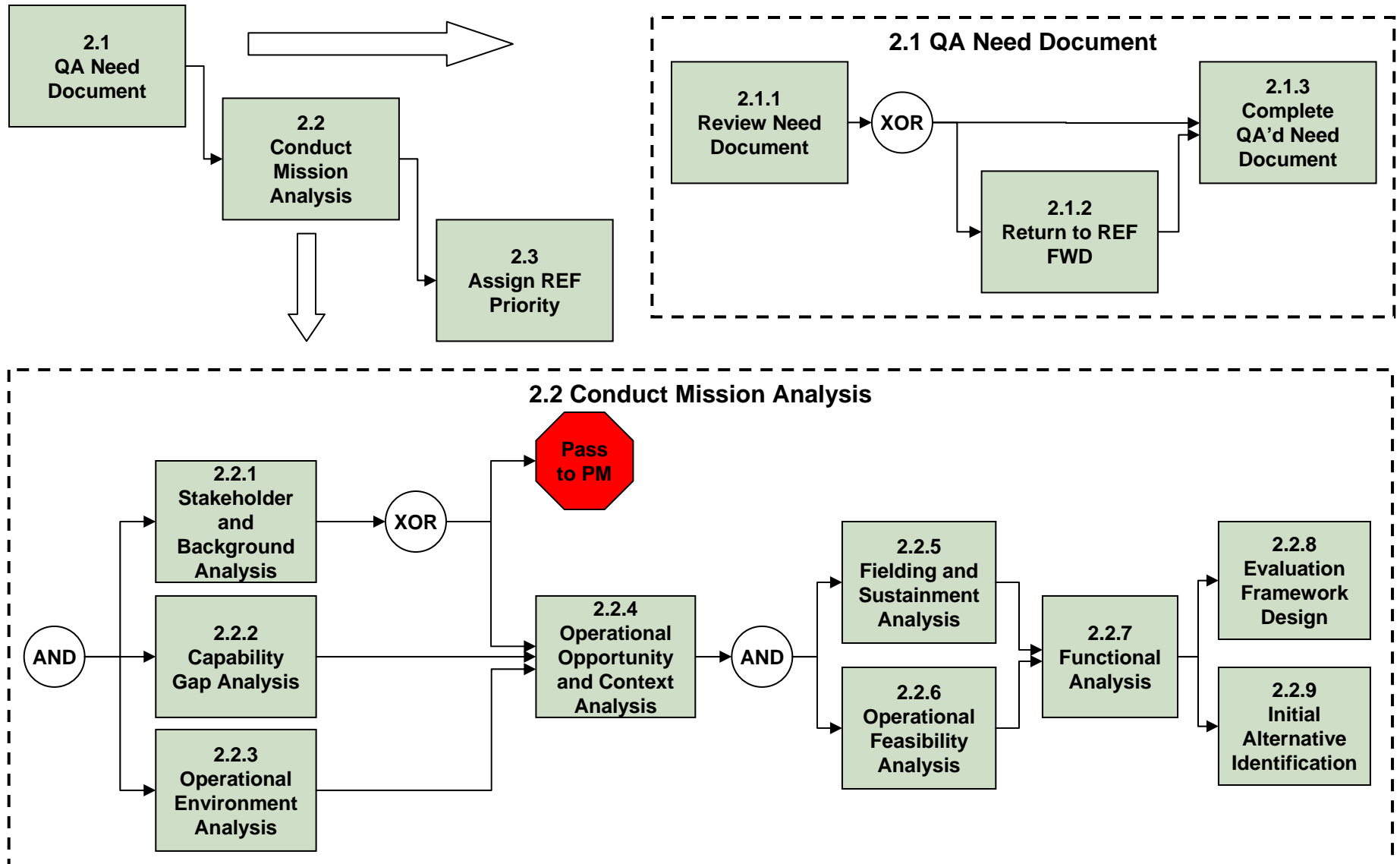


TM – Technology Management

QA – Quality Assurance

2.0 Requirements Analysis / Project Validation

Sub-processes



REF FWD – REF Forward Element in Theater

2.0 Requirements Analysis / Project Validation

Discussion (Slide 1 of 4)

- **Purpose:** To transform an initial need identification into a thorough set of requirements by refining the initial need documentation and conducting a detailed mission (need) analysis.
- **Rationale:** As with the initial identification of the need, this essential step in defining the problem and determining the requirements is critical to the success of the project. The requirements identified in this process is the foundation upon which the ultimate recommendation of a solution and the implementation plan will be based.
- **Inputs:** The primary input to this process is a 10-Liner, Operational Need Statement (ONS), or a Joint Use Operational Need Statement (JUONS). Inputs could also include documentation from the REF Technology Management team as they vet 'good ideas', new technologies, insert technologies, or command-directed technologies.
- **Sub-process Discussion:**
 - **2.1 QA Need Document:** In this step, the team receives a need identification from the field (10-Liner, ONS, JUONS) and reviews it for completeness. If the documentation is missing critical information, the team returns it to the originator for clarification. Some information is not required to be complete in the Need Document (e.g., organizational concept, procurement objective, support requirements, and availability). The output is a QA'd need document.
 - **2.2 Conduct Mission Analysis:** This is a very complex step and includes numerous sub-steps to ensure that the initial need statement is accurately transformed into a thorough set of requirements. A discussion of these sub-steps is essential to understand this process.
 - **2.2.1 Stakeholder and Background Analysis:** The team begins this step immediately and continues to execute it throughout the entire process. A stakeholder can be defined as anyone with a vested interest in, or influence upon, the problem. The team will identify and interview stakeholders for almost every aspect of Mission Analysis. Because time is a limited commodity for all stakeholders, the team must put thought into the information they need before they begin their interviews. Key stakeholders will include the unit, threat subject matter experts (SMEs), other operational SMEs, REF personnel, project managers (PMs), maintenance and sustainment SMEs, industry, and other personnel who can help provide or clarify required information. Additionally, the team will check with DAMO-CIC to determine if they are working on a similar ONS prior to an AR2B. In conjunction with interviewing stakeholders, the team will also conduct background research to clarify their information. The key outputs of this step are a correspondence history and the information provided by the stakeholders and through the background research. In some cases, if a PM solution has been identified to meet the need, this process can end with transition to the PM.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 2 of 4)

- **Sub-process Discussion (continued):**

- **2.2 Conduct Mission Analysis (continued):**

- **2.2.2 Capability Gap Analysis:** The team will refine the capability gaps identified by the REF FWD team (if provided) and identify applicable sub-capability gaps as well. The team should try to identify the frequency with which the gap occurs and the impact of the gap on the unit.
 - **2.2.3 Operational Environment Analysis:** The team will describe the operational environment in which the solution will be used, identify ROE and other legal considerations, and understand the threat and how the threat might defeat and/or adapt to the employment of the solution.
 - **2.2.4 Operational Opportunity and Context Analysis:** This analysis captures how the potential solution may be employed, in terms of tactics, techniques and procedures (TTPs), identifies potential drawbacks/penalties of the system, identifies other systems with which the potential solution will have to interoperate, identifies how often the potential system will be available to the unit for use, and how often situations will occur for which the system will provide benefit. The latter two analyses help the REF determine if the fielded solution will actually provide significant benefit to the unit, versus only occasional benefit. These results should be balanced with the frequency and impacts of the gap itself to help the REF prioritize the current requirement with other competing requirements.
 - **2.2.5 Fielding and Sustainment Analysis:** This analysis captures the number of systems that are required and whom they will be fielded to (basis of issue – number by echelon), the expect logistical footprint required to support the system (manpower, spares, facilities, special equipment) and an initial estimate of the lifecycle cost (procurement, maintenance, sustainment, etc.) of a potential solution (to help identify the funding source) and an estimate of the fielding schedule.
 - **2.2.6 Operational Feasibility Analysis:** This analysis captures the organization, training, leader education, and personnel impacts of fielding the system and includes the human factors issues (comfort, usability, etc.) associated with the fielded systems' impacts on the users, leaders, and maintainers.
 - **2.2.7 Functional Analysis:** This analysis defines in greater detail the required functions of the system in terms of what the system must do in order to mitigate the capability gap and satisfy the unit's need. This is primary step for defining the requirements of the potential materiel solution and provides the basis for alternative identification and the evaluation framework that will be used to compare the alternatives. It is important, when defining the functions, to define them independently of potential solutions already being considered.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 3 of 4)

- **Sub-process Discussion (continued):**

- **2.2 Conduct Mission Analysis (continued):**

- **2.2.8 Evaluation Framework Design:** This step should flow directly from the functional analysis and the stakeholder analysis. The objectives of the stakeholders should be combined with the required functions to define the desired performance by function. The team will then derive criteria from those objectives that will be used to measure and evaluate alternative performance. Criteria come from the system attributes defined in the 10-Liner, measures suggested by stakeholders, and other measures developed by the team. Criteria must be developed in such a way that is not specific to a particular solution so that they can be used to evaluate any potential alternative. Criteria can either be natural (a clearly defined and understood scale, like pounds) or constructed (created specifically to measure the performance of a particular function/objective, such as a 5-star rating for safety). Once a list of criteria has been established, the team must weight the criteria according to the importance of the primary stakeholders, so that comparisons can be made. The evaluation framework will be refined and completed later by the Project Officer.

- **2.2.9 Initial Alternative Identification:** In this step, the team will compile a set of potential solutions, which will come from the unit, other stakeholders, and other sources. The team should consider non-materiel alternatives within the DOT_LPF* domains as well.

- **2.3 Assign REF Priority:** The requirements team should assign a priority (routine, essential, or urgent) to the requirement based primarily upon unit/REF FWD recommendation, but also upon the Mission Analysis conducted as part of this process.

*DOT_LPF: Doctrine, Organization, Training, Leader Education, Personnel, Facilities (Materiel omitted)

- **Potential Tools and Techniques:**

- **Stakeholder Analysis:** The key to the success of this process is the interaction between the REF analysis teams and key stakeholders.

- **TRADOC ARCIC Current Force Capability Gap Documentation:** Provides a description of the currently-approved capability gaps, sub-capability gaps, and potential solutions for mitigating the gaps.

- **Human Systems Integration (HSI) Tool:** Tool developed by TRAC-MTRY to assist in the identification of potential HSI and DOTMLPF issues associated with fielding a materiel solution.

- **System Decomposition:** A technique to decompose the required solution into its component parts, structure, and functions. This is a good technique for gaining an understanding of the system and its key elements.

2.0 Requirements Analysis / Project Validation

Discussion (Slide 4 of 4)

- **Potential Tools and Techniques (continued):**

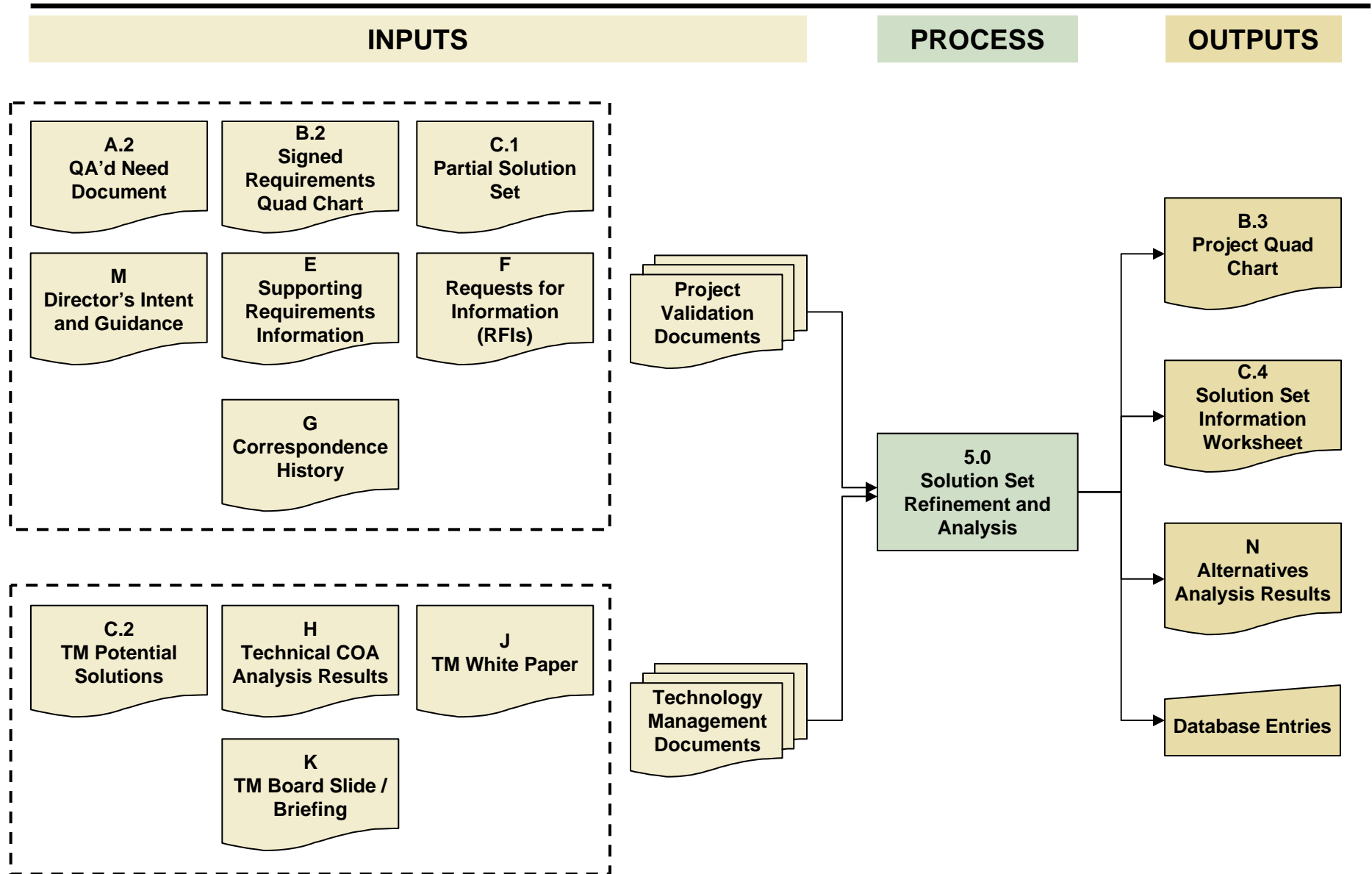
- **System Context Diagram:** A technique used to place the system and its sub-systems in the context of the operational environment, which is helpful for identifying interoperability issues, potential TTPs, and echelon of system employment.
- **Legal Advice:** Army lawyers can help identify unique legal requirements for certain types of systems under consideration.
- **Functional Decomposition:** Techniques, such as functional hierarchies and functional flow diagrams, used to decompose the need into required functions.
- **Objectives:** A method of thinking that translates required functions into desires concerning performance that can help lead directly into the criteria or measures for alternative evaluation.
- **Value Measures:** Techniques for developing criteria to capture the value of the key aspects of alternative performance for evaluation and comparison purposes.
- **Value Hierarchy:** Technique used to capture the evaluation framework that starts with the functions and flows into objectives and then criteria, or value measures.

- **Outputs:**

- **QA'd Need Document.**
- **Requirements Quad Chart:** Pre-defined REF document that includes a succinct description of the problem (this should be a more complete, revised problem statement that builds upon the initial problem statement included in the Need Document), a photo of the potential solution (if identified), a description of the system (either explicitly, if a solution has been identified, or in terms of requirements if a solution has not been identified), the applicable TRADOC ARCIC Current Force capability gap(s) and sub-capability gap(s), proposed and recommended courses of action for the procurement of the solution, the requesting activity, identification of similar items REF may have considered in the past, an initial sustainment strategy, and a potential vendor (if identified).
- **Partial Solution Set:** A set of potential materiel solutions described in an Excel spreadsheet.
- **REF Priority.**
- **All of the supporting Requirements Analysis / Project Validation products.**
- **Unanswered Request for Information (RFIs).**
- **Stakeholder Correspondence History:** A log of the critical discussions between the requirements team and key stakeholders.
- **Required Database Entries.**

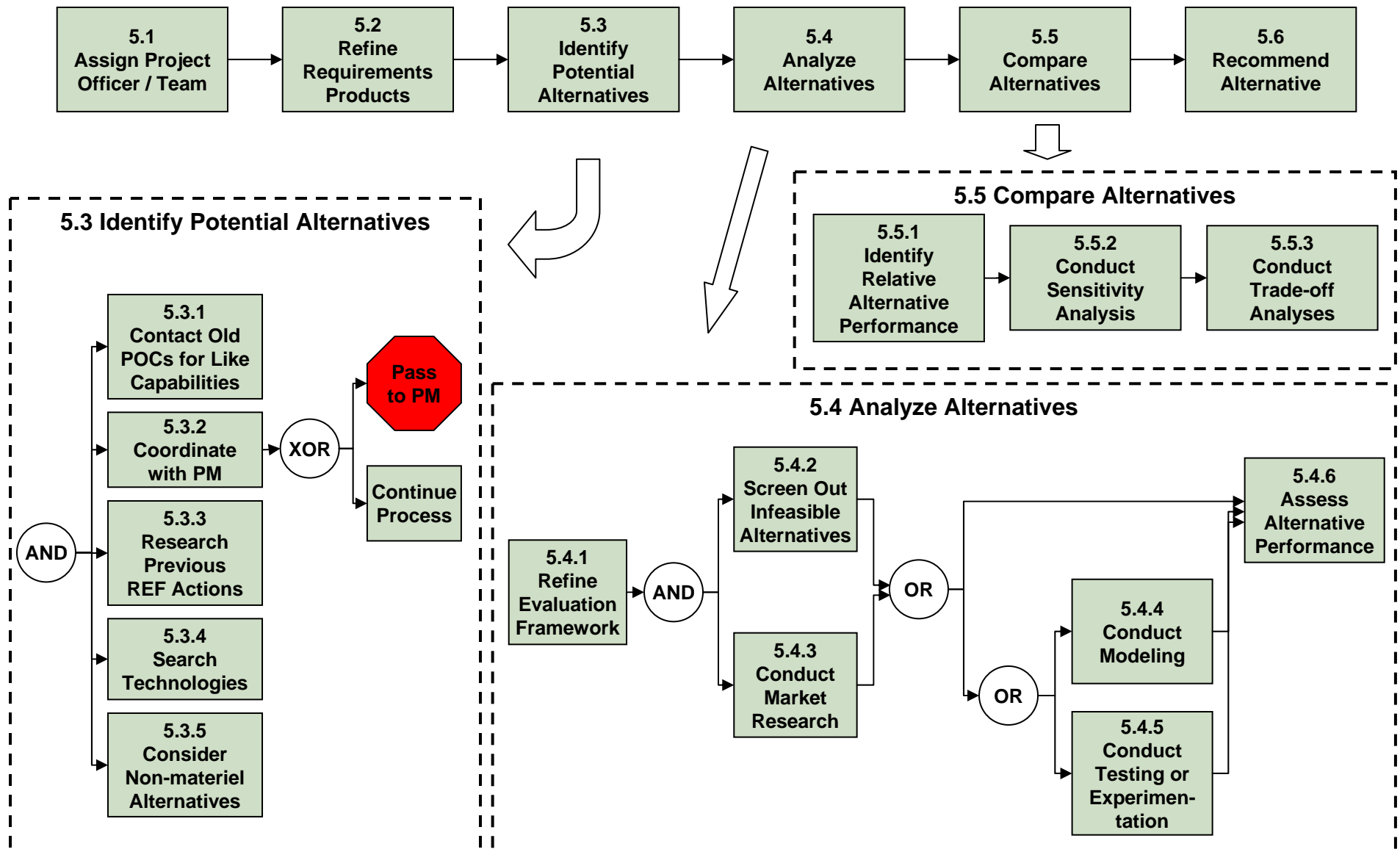
5.0 Solution Set Refinement and Analysis

Inputs to Outputs



5.0 Solution Set Refinement and Analysis

Sub-processes



PM – Project Manager POC – Point of Contact

5.0 Solution Set Refinement and Analysis

Discussion (Slide 1 of 5)

- **Purpose:** To identify, analyze, and compare potential solutions to the stated requirement and to recommend the best potential solution.
- **Rationale:** This step builds upon the foundation provided by the Requirements Analysis to identify the best solution. Thus, this process will determine the system that gets fielded to the operational unit, and is therefore central to the REF process. It is critical that this step be performed well to provide the best performing solution at the best cost that will meet the unit's needs.

- **Inputs:**
 - Project Validation Documents:
 - QA'd Need Document.
 - Signed Requirements Quad Chart.
 - Partial Solution Set.
 - Director's Guidance.
 - Supporting Requirements Information.
 - Unanswered Requests for Information.
 - Correspondence History.
 - Technology Management Documents:
 - TM Potential Solutions.
 - Technical COA Analysis Results.
 - TM White Paper.
 - TM Board Slide/Briefing.

- **Sub-process Discussion:**
 - **5.1 Assign Project Officer Team:** In this step, the requirement is received by the project team and a Project Officer is identified. Other team members are given a heads up concerning the new requirement so that parallel planning can be executed. This step also involves scoping the effort.
 - **5.2 Refine Requirements Products:** In this step, the Project Officer examines the documentation from the Requirements Analysis and refines any information the Project Officer deems insufficient or missing. This step also includes pursuing any unanswered RFIs.
 - **5.3 Identify Potential Alternatives:** This involves a thorough process of identifying all possible solutions to meet the unit need. The Project Officer can accomplish this step by contacting old POCs for like capabilities, coordinating with acquisition PMs for capabilities current part of...

5.0 Solution Set Refinement and Analysis

Discussion (Slide 2 of 5)

- **Sub-process Discussion (continued):**

- **5.3 Identify Potential Alternatives (continued):** ... of their programs, researching previous REF activities for like solutions, searching existing technologies through a variety of search engines, and considering non-materiel (DOT, LPF) alternatives. The project officer will also have input from the unit, the TM COA analysis (if conducted), and the Requirements Analysis team. This step may result in passing the project to an appropriate PM, if one has been identified.
- **5.4 Analyze Alternatives:** This is a very complex step and includes numerous sub-steps to methodically analyze the set of potential alternatives. A discussion of these sub-steps is essential to understand this process.
 - **5.4.1 Refine Evaluation Framework:** A detailed discussion of this task can be found in the discussion for process 2.2.8. Here, the Project Officer refines that original analysis by ensuring that a complete framework is defined. This step may have only been partially completed during the requirements analysis and should be completed here. Additionally, the identification of new alternatives will often require changes to the framework.
 - **5.4.2 Screen Out Infeasible Alternatives:** As part of the evaluation framework design, and at other parts of the Requirements Analysis, the analysts may have identified constraints upon the system. These are conditions that the system *must* meet in order to be feasible solutions. These may come from the unit or other stakeholders, such as the REF Director. If these have not been defined previously, they should be compiled here. Once a complete list of system constraints has compiled, the analyst should remove from consideration any alternative that does not meet the constraints. Prior to this step, alternatives should have been developed without considering these constraints.
 - **5.4.3 Conduct Market Research:** In this step, the Project Officer conducts research on each of the remaining feasible alternatives to determine as much information about each of the alternatives as possible. At a minimum, the Project Officer must be able to characterize the alternative performance for each of the criteria within the evaluation framework. If information concerning those alternatives is incomplete, the Project Officer must either estimate the performance or change the criterion in a way that can be evaluated for all alternatives. This may require changing the criterion from a natural measure, that may not be possible to estimate, to a subjective measure, that is more flexible. Included in this step is a refinement of the lifecycle cost estimate for each alternative.
 - **5.4.4 Conduct Modeling:** This step is an optional, but often used, process used to estimate the performance of an alternative for one or more criteria. Models can range from simple mathematical approximations to large simulation models. The specific type of model used depends greatly on the solution set, the criteria to be estimated, and the time available to conduct the analysis.

5.0 Solution Set Refinement and Analysis

Discussion (Slide 3 of 5)

- Sub-process Discussion (continued):

- 5.4 Analyze Alternatives (continued):

- 5.4.5 Conduct Testing or Experimentation: This is an optional step used to estimate alternative performance for one or more criteria. This process usually involves the procurement of one or more of the candidate alternatives and consists of placing the system under the appropriate operating conditions and evaluating the performance. The use of this step depends upon the time available, system availability and cost, and the testing / experimentation capabilities of the REF, and can occur after fielding candidate systems to the unit. This process can potentially be performed by an testing / experimentation agency, such as the US Army Test and Evaluation Command (ATEC).
 - 5.4.6 Assess Alternative Performance: This step consists of compiling the alternative performance for each alternative with respect to each criterion into a single product for comparison. If quantitative analysis is not going to be used, this set of data will be examined in the next process to determine the best alternative. If quantitative analysis is to be used, the raw data must be converted a common scale (often called value scoring) for comparative purposes, allowing an 'apples-to-apples' comparison.

- 5.5 Compare Alternatives:

- 5.5.1 Identify Relative Alternative Performance: The endstate of this process is a rank-ordered list of the potential solutions based upon their expected performance. If quantitative analysis is not to be used, the Project Officer must look at the raw performance data and manually rank order the alternatives based on that data and based upon comparisons with the requirements defined earlier in the process. If quantitative analysis is being used, the Project Officer will use the criteria weights in combination with the common scales (value scales) for the alternative performance to calculate a total value score for each alternative. The alternatives will then be ranked according to those value scores.
 - 5.5.2 Conduct Sensitivity Analyses: Since much of the analysis done to rank the alternatives is subjective in nature (regardless of whether the analysis is quantitatively- or qualitatively-based), some examination of the assumptions that led to the recommended alternative must be conducted. For quantitative analyses, sensitivity analyses often involve examining the criteria weighting in order to identify those cases when small, realistic changes to the weights change the recommended alternative. Additionally, sensitivity analyses should also examine how plausible changes to the estimated performance can affect the final recommended alternative.

5.0 Solution Set Refinement and Analysis

Discussion (Slide 4 of 5)

- **Sub-process Discussion (continued):**

- **5.5 Compare Alternatives (continued):**

- **5.5.3 Conduct Trade-off Analyses:** This process involves examining the trade-offs between alternative performance and key selected parameters, such as cost, availability, etc., which are treated as independent variables. It usually consists of plotting the alternative performances (or total value scores) against the independent variable and determining how much performance (or value) is gained by added cost, longer delivery times, etc. It is important, for plots of performance versus the selected key parameter, that the parameter is not also included in the calculation of the overall alternative performance, which would lead to double-counting.

- **5.6 Recommend Alternative:** Based upon the overall alternative comparison results, sensitivity analyses, and trade-off analyses, the Project Officer makes a recommendation for a particular solution. In some cases in quantitative analyses, the recommended alternative may be different from the highest scoring alternative based upon the results of the sensitivity or trade-off analyses, or based upon other, non-quantifiable aspects. Quantitative results should never be allowed to override common sense; however, the Project Officer should be able to defend thoroughly any recommendation and should be prepared to show key analysis results to the decision-maker.

- **Potential Tools and Techniques:**

- **Value-focused Thinking:** The same tools discussed in Process 2.0, such as objectives, value measures, value scores and curves, and the value hierarchy.
 - **Technology Search Tools:** Tools such as Google and more specific search engines, designed to identify potential alternatives.
 - **Constraints and Feasibility Matrices:** Techniques and tools to define system criteria and to facilitate alternative screening.
 - **Systems Comparison Matrix:** A REF-designed product in an Excel spreadsheet used to capture the key performance information of each of the alternatives.
 - **Models and Simulation:** A wide range of tools and techniques to estimate alternative performance under operational conditions.
 - **Experimental Design:** Techniques to systematically vary key alternative factors during experimentation to ensure that the team can make statistically valid estimates of alternative performance based upon the experimental results.

5.0 Solution Set Refinement and Analysis

Discussion (Slide 5 of 5)

- **Potential Tools and Techniques (continued):**

- **Sensitivity Analyses:** Techniques to examine the sensitivity of criteria weights and alternative scores.
- **Cost-benefit Plots:** Plots of alternative performance (or total value scores) against cost, availability, etc., used for trade-off analyses.
- **Decision Support Tool:** Developed by TRAC-MTRY to facilitate simple and more complex criteria weighting techniques, simple and more complex alternative scoring techniques, and to provide alternative comparison, sensitivity analysis, and cost-benefit charts.

- **Outputs:**

- **Project Quad Chart:** Pre-defined REF document of the same format as the Requirements Quad Chart. This chart should have all information concerning the system characteristics, photo, cost, schedule, etc., that may have been incomplete on the Requirements Quad Chart.
- **Solution Set Information Worksheet:** A spreadsheet containing detailed information concerning every potential solution considered during the process.
- **Alternatives Analysis Results:** All of the analysis products, such as charts, spreadsheets, models, etc., resulting from the Solution Set Refinement and Analysis process.